A10 cont

maximum thresholds (Step 92). The minimum and maximum thresholds represent a variable range for each of a plurality of received signal levels y(k).--

Paragraph beginning at page 12, line 11, has been replaced with the following rewritten paragraph:

A11

-- The process for generating a constellation design begins at step 80. At step 82, a central site modem transmits a training sequence through the communication channel to the receiver 10 located in a client site modem. At step 84, the transmitted training sequence is used to identify the probability density functions representative of the probability that a signal y(k) is received given that a signal t(i) is transmitted. These conditional probabilities are given the notation: $f_Y[y(k)/t(i)]$. Typically, the training sequence transmitted by the central site modem includes the transmission of L Pulse Code Modulation levels being sent N times, wherein $12 < N < 100$. The client site modem receives the corresponding data L(1), L(2), . . . L(N); i.e. the client site modem receives the signal L(i).--

Paragraph beginning at page 15, line 7, has been replaced with the following rewritten paragraph:

A12

-- The method for identifying a message begins at step 100. At step 102 the receiver 10 receives the transmitted signal. After step 102, the method proceeds to steps 82, 84, 86, 88, 90, and 92. In one alternative embodiment of the invention, step 102 can be performed after step 95 and before step 104. Steps 82-92 are fully described under the description of FIG. 7.--

Paragraph beginning at page 15, line 21, has been replaced with the following rewritten paragraph:

A13

-- At step 104, the receiver 10 compares the received signal with the minimum and maximum thresholds. For example, the comparator 14 compares the received signal level with the threshold signals received from the processor (e.g., table) 12. The threshold signals represent the constellation design similar to that illustrated in FIG. 6. By comparing the threshold signals to the received signal the comparator can identify which decision region contains the received signal level. Based on this comparison, the comparator then generates the output signal M. After step 104, the method of identifying the message ends at step 106.--

<u>IN THE CLAIMS</u>

Claims 1, 10, 19-21, 25, 32, and 36 have been amended as follows:

A14

1. (Once amended) A receiver for identifying a message based upon a received signal, the receiver comprising:

a processor that generates a minimum threshold and a maximum threshold representing a range for each of a plurality of possible message levels, wherein the sizes of the ranges are different for at least two of the message levels, and

a comparator that identifies the message by comparing the received signal with the generated minimum and maximum thresholds.

A15 cont

10. (Once amended) A method of forming a constellation design having a selected number of (i) message levels, the constellation design forming part of a receiver that identifies a transmitted message based upon a received signal, the method comprising:

determining a minimum threshold and a maximum threshold representing a range for each of a plurality of possible signal levels, and

A15 cont.

calculating the distance d(i) between the maximum threshold for possible signal level (i) and the minimum threshold for possible signal level (i+1).

19. (Once amended) The method according to claim 18, further comprising the step of calculating the Lmse(i) according to the equation:

Lmse = $\alpha\sigma^2$,

where α is a coefficient parametrically defined by the following equation

A16

$$P0 = \frac{\int_{-\alpha\sigma^2}^{\alpha\sigma^2} e^{\frac{-x^2}{2\sigma^2}}dx}{\int_{-\infty}^{\infty} e^{\frac{-x^2}{2\sigma^2}}dx}$$

, where P0 is a selected probability and x is an integration variable.

20. (Once amended) A receiver for identifying a transmitted message based upon a received signal, the receiver comprising:

a processor for generating a constellation design having a minimum threshold and a maximum threshold for each of a plurality of possible signal levels, the minimum and maximum thresholds for each possible signal level representing a range that may differ between possible signal levels, and

a comparator that identifies the transmitted message by comparing the received signal with the generated constellation design and that generates an output signal representative of the transmitted message.

21. (Once amended) A method of identifying a message based upon a received signal, the method comprising:

receiving the signal,

providing a minimum threshold and a maximum threshold representing a range for each of a plurality of possible message levels, wherein the sizes of the ranges are different for at least two of the message levels, and

identifying the message by comparing the received signal with the generated minimum and maximum thresholds.

A17

25. (Once amended) The method according to claim 21, further comprising the step of calculating a variable range Lmse(i) for each possible message level Y, Lmse(i) representing one-half the distance between the minimum and maximum thresholds for each possible message level, wherein the minimum and maximum thresholds define a range wherein the probability of correctly receiving a selected signal exceeds a selected probability P0.

A18

32. (Once amended) The method according to claim 21, further comprising the steps of:

identifying a probability density function for each possible signal level Y, and

identifying the minimum and maximum thresholds as the boundaries of a range in the identified probability density function wherein the probability of correctly receiving a selected message level exceeds a selected probability P0.

A19 cont.

36. (Once amended) The method according to claim 35, further comprising the step of calculating the Lmse(i) according to the equation:

Lmse = $\alpha\sigma^2$,

where α is a coefficient parametrically defined by the following equation

A19 Concl

$$P0 = \frac{\int_{-\alpha\sigma^2}^{\alpha\sigma^2} e^{\frac{-x^2}{2\sigma^2}} dx}{\int_{-\infty}^{\infty} e^{\frac{-x^2}{2\sigma^2}} dx}$$

, where P0 is a selected probability and x is an integration variable.

New claims 37-50 have been added as follows:

37. A receiver for identifying a message based upon a received signal, the receiver comprising:

a processor that generates a minimum threshold and a maximum threshold representing a variable range for each of a plurality of possible message levels, and

a comparator that identifies the message by comparing the received signal with the generated minimum and maximum thresholds, wherein the minimum and maximum thresholds are a function of an interrelationship between noise and the message level.

38. A receiver for identifying a message based upon a received signal, the receiver comprising:

a processor that generates a minimum threshold and a maximum threshold representing a variable range for each of a plurality of possible message levels, and

a comparator that identifies the message by comparing the received signal with the generated minimum and maximum thresholds, wherein the minimum and maximum thresholds define a range wherein the probability of correctly receiving a selected signal exceeds a selected probability P0.

A20 Cont

39. A method of forming a constellation design having a selected number of (i) message levels, the constellation design forming part of a receiver that identifies a transmitted message based upon a received signal, the method comprising:

determining a minimum threshold and a maximum threshold representing a variable range for each of a plurality of possible signal levels, and

calculating the distance d(i) between possible signal levels based upon the determined minimum and maximum thresholds, wherein the determining step comprises the steps of:

identifying a probability density function for each possible signal level Y, and

identifying the minimum and maximum thresholds as the boundaries of a range in the identified probability density function wherein the probability of correctly receiving a selected message level exceeds a selected probability P0.

40. A method of forming a constellation design having a selected number of (i) message levels, the constellation design forming part of a receiver that identifies a transmitted message based upon a received signal, the method comprising:

determining a minimum threshold and a maximum threshold representing a variable range for each of a plurality of possible signal levels, and

calculating the distance d(i) between possible signal levels based upon the determined minimum and maximum thresholds, including the steps of:

determining the mean value, Lev(i), for a selected variable range identified by a selected set of minimum and maximum thresholds, and

calculating the distance d(i) as a function of Lev(i) in accordance with the equation:

d(i) = Lev(i+1) – Lev(i) – Lmse(i+1) – Lmse(i);

wherein the term "i+1" identifies a message level adjacent the i^{th} message level in the constellation design for the receiver and wherein Lmse(i) is the level mean square error for the i^{th} message level.

41. A method of forming a constellation design having a selected number of (i) message levels, the constellation design forming part of a receiver that identifies a transmitted message based upon a received signal, the method comprising:

determining a minimum threshold and a maximum threshold representing a variable range for each of a plurality of possible signal levels;

calculating the distance d(i) between possible signal levels based upon the determined minimum and maximum thresholds, including the steps of:

determining the mean value, Lev(i), for a selected variable range identified by a selected set of minimum and maximum thresholds, and

calculating the distance d(i) as a function of Lev(i); and

identifying whether the calculated distance $d(i) > d_{min}$, wherein d_{min} represents a selected minimum value.

42. A method of identifying a message based upon a received signal, the method comprising:

receiving the signal,

generating a minimum threshold and a maximum threshold representing a variable range for each of a plurality of possible message levels, and

identifying the message by comparing the received signal with the generated minimum and maximum thresholds, wherein the minimum and maximum thresholds are a function of the interrelationship between noise and the message level.

43. A method of identifying a message based upon a received signal, the method comprising:

receiving the signal,

generating a minimum threshold and a maximum threshold representing a variable range for each of a plurality of possible message levels, and

identifying the message by comparing the received signal with the generated minimum and maximum thresholds, wherein the generating step includes the step of calculating a variable range Lmse(i) for each possible message level Y, Lmse(i) representing one-half the distance between the minimum and maximum thresholds for each possible message level, wherein the minimum and maximum thresholds define a range wherein the probability of correctly receiving a selected signal exceeds a selected probability P0.

44. A method of identifying a message based upon a received signal, the method comprising:

receiving the signal,

generating a minimum threshold and a maximum threshold representing a variable range for each of a plurality of possible message levels,

identifying the message by comparing the received signal with the generated minimum and maximum thresholds, and

determining a distance d(i) between received signal levels, the distance d(i) having different values for a plurality of message levels, including the steps of:

determining the mean value, Lev(i), for a selected variable range identified by a selected set of minimum and maximum thresholds, and

calculating the distance d(i) as a function of Lev(i).

45. A method of identifying a message based upon a received signal, the method comprising:

receiving the signal,

generating a minimum threshold and a maximum threshold representing a variable range for each of a plurality of possible message levels,

identifying the message by comparing the received signal with the generated minimum and maximum thresholds,

determining a distance d(i) between received signal levels, the distance d(i) having different values for a plurality of message levels, and

identifying whether the determined distance d(i) > d_{min}, wherein d_{min} represents a selected minimum value.

46. A method of identifying a message based upon a received signal, the method comprising:

receiving the signal;

generating a minimum threshold and a maximum threshold representing a variable range for each of a plurality of possible message levels, including the steps of:

identifying a probability density function for each possible signal level Y, and

identifying the minimum and maximum thresholds as the boundaries of a range in the identified probability density function wherein the probability of correctly receiving a selected message level exceeds a selected probability P0; and

identifying the message by comparing the received signal with the generated minimum and maximum thresholds.

47. A method of identifying a message based upon a received signal, the method comprising the steps of:

receiving the signal;

providing a minimum threshold and a maximum threshold representing a range for each of a plurality of possible message levels, wherein the maximum threshold for a possible message level (i) is separated from the minimum threshold for a possible message level (i+1) by a distance d(i); and

identifying the message by comparing the received signal with the minimum and maximum thresholds.

48. The method of claim 47, wherein the sizes of the ranges are different for at least two of the message levels.

49. The method of claim 47, wherein the distances d(i) are different for at least two different pairs of message levels.

50. The method of claim 47, further comprising the step of generating the minimum and maximum thresholds using transmitted training signals.